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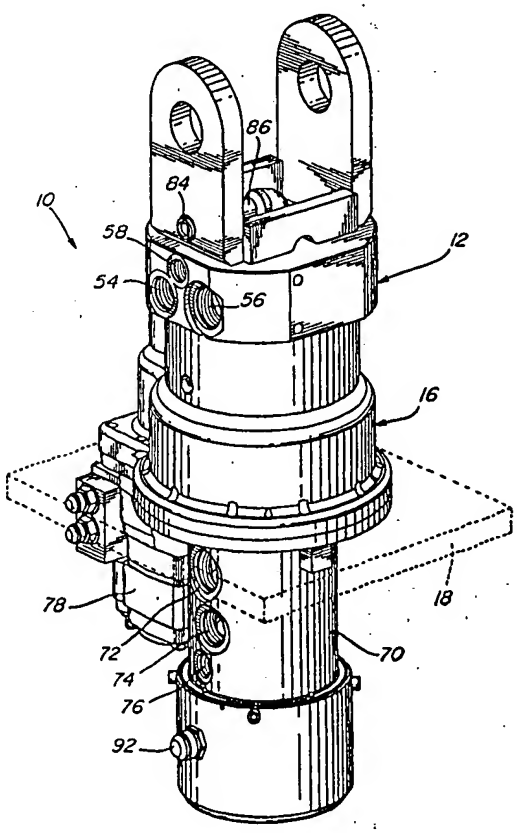
(54) Title: CONTINUOUS ROTARY LINK FOR MULTIFUNCTION HEAD

(57) Abstract

A continuous rotary link (10) to be mounted between an articulated boom (14) of a vehicle and a multifunction head (18) is described herein. The continuous rotary link (10) includes a fixed assembly (12) mounted to the articulated boom (14) and a rotatable assembly (16) rotatably mounted to the fixed assembly (12) and to which the multifunction head (18) may be mounted. Fluid transmission circumferential channels (64, 66, 68) are provided between the fixed and rotatable assemblies (12, 16) to allow hydraulic fluid to be transferred between these two assemblies even during the relative rotation of the rotatable assembly (16) with respect to the fixed assembly (12). The continuous rotary link also includes electrical connectors (94, 96, 98, 100) so mounted to the fixed and rotatable assemblies (126, 128, 130, 132) as to remain in electrical contact during the rotation of the rotatable assembly (16). Electrical signals may therefore be exchanged between the fixed and rotatable assemblies (12, 16) during the continuous rotation of the rotatable assembly (16).



## TITLE OF THE INVENTION

CONTINUOUS ROTARY LINK FOR MULTIFUNCTION HEAD

## FIELD OF THE INVENTION

The present invention relates to rotary links. More specifically, the present invention is concerned with a continuous rotary link to be mounted between an articulated boom of a vehicle and a multifunction head to enable the multifunction head to continuously rotate with respect to the boom.

## BACKGROUND OF THE INVENTION

Continuous rotary links interconnecting grapples and articulated booms are widely known in the art. These rotary links usually include a body enclosed in a sheath where at least two grooves are provided between the body and the sheath. Fluid, generally oil, may thus be transmitted between the boom and the grapple even during the rotation of the grapple with respect to the boom.

United States Patent N° 5,441,090 issued on August 15, 1995 to Terrence Hill *et al.* and entitled: "TREE CUTTING AND WOOD MANIPULATING GRAPPLE" describes a grapple provided with an hydraulically powered saw and mounted to the boom of a vehicle via a continuous rotary link joint designed to allow fluid to be transmitted from the boom to the grapple while they are rotated relative to each other. Since the saw mounted to the grapple is hydraulically powered by the

fluids transmitted via the rotary link, it may be actuated at any angular position of the grapple with respect to the boom.

A major drawback of the grapple of Hill *et al.* is that the number of grooves in the rotary link is increased by the use of a hydraulically powered saw. Indeed, since no control is possible at the grapple level, each hydraulically powered device provided on the grapple must be supplied via an independent fluid line connected to a separate output of the rotary link to allow the user to control each device independently.

## OBJECTS OF THE INVENTION

An object of the present invention is therefore to provide an improved continuous rotary link.

Another object of the invention is to provide a continuous rotary link provided with electrical connectors enabling electrical signals to be exchanged between the vehicle and the multifunction head.

## SUMMARY OF THE INVENTION

More specifically, in accordance with the present invention, there is provided a continuous rotary link for a multifunction head comprising:

a fixed assembly having a longitudinal axis;

a rotatable assembly mounted to the fixed assembly; the rotatable assembly being rotatable about the longitudinal axis;

means for transmitting fluid from the fixed assembly to the rotatable assembly; the fluid transmitting means having a first portion mounted to the fixed assembly and a second portion mounted to the rotatable assembly;

at least one electrical signal transmission assembly including a first electrical connector mounted to the fixed assembly and a second electrical connector mounted to the rotatable assembly; one of the first and second electrical connectors being circular and coaxial with the longitudinal axis; the other of the first and second electrical connector contacting the one electrical connectors and running on the one electrical connector upon rotation of the rotatable assembly about the axis;

whereby an exchange of electrical signals between the fixed assembly and the rotatable assembly is enabled by the continuous electrical contact between the first and second electrical connectors.

According to another aspect of the present invention, there is provided a continuous rotary link for a multifunction head comprising:

a fixed assembly having a longitudinal axis;

a rotatable assembly rotatably mounted to the fixed assembly and configured to receive the multifunction head;

means for transmitting fluid between the fixed assembly and the rotatable assembly; the fluid transmitting means having a first portion mounted to the fixed assembly and a second portion mounted to the rotatable assembly;

means for transmitting electrical signals between the fixed assembly and the rotatable assembly; the electrical signal transmitting means having a first portion mounted to the fixed assembly and a second portion mounted to the rotatable assembly.

It is to be noted that the term "multifunction head" used herein and in the appended claims is to be construed as any attachment to be mounted to an articulated and/or telescopic boom of a vehicle, including a controller configured to receive electrical signals from the vehicle and to control specific elements of the attachment in response to these electrical signals.

Other objects, advantages and features of the present invention will become more apparent upon reading of the following non restrictive description of preferred embodiments thereof, given by way of example only with reference to the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the appended drawings:

Figure 1 is a perspective view illustrating a continuous rotary link according to an embodiment of the present invention provided between a boom of a vehicle and a multifunction head;

Figure 2 is a perspective view illustrating an enlarged view of the continuous rotary link of Figure 1;

Figure 3 is a exploded perspective view of the continuous rotary link of Figure 1;

Figure 4 is a side elevational view of the electrical connectors of the continuous rotary link of Figure 1; and

Figure 5 is a sectional view taken along line 5-5 of Figure 4.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to Figure 1 of the appended drawings, a continuous rotary link 10 according to an embodiment of the present invention will be described.

The continuous rotary link 10 includes a fixed assembly, generally denoted 12, shown mounted to the end of an articulated boom 14, illustrated in dashed lines, and a rotatable assembly, generally denoted 16, rotatably mounted to the fixed assembly 12 and to which a harvesting head 18, illustrated in dashed lines, is mounted.

It is to be noted that the harvesting head 18 is only an example of a multifunction head that could be mounted to the rotatable assembly 16. It is also to be noted that the articulated boom 14 could be replaced by a telescopic boom (not shown).

As will be easily understood by one skilled in the art, the continuous rotary link 10 enables hydraulic fluid to be exchanged between three hydraulic fluid conduits 20, 22 and 24 of the vehicle (not shown) and three hydraulic fluid conduits 26, 28 and 30 of the harvesting head 18. These three hydraulic fluid conduits 26, 28 and 30 are sufficient to provide fluid pressure to operate the various devices of the harvesting head 18 as will be described hereinafter. Indeed, the fluid conduit 28 is used to supply hydraulic fluid from a hydraulic fluid reservoir (not shown) at a predetermined pressure, the conduit 26 is the return conduit to the

hydraulic fluid reservoir and the third hydraulic fluid conduit 30 is a drain returning to the fluid reservoir.

As mentioned hereinabove, one feature of the present invention is to enable electrical signals to be exchanged between the vehicle and the harvesting head 18 while allowing continuous rotation of the harvesting head 18 about a rotation axis 32. An multiple conductor electrical cable 34 is therefore connected to the fixed assembly 12 and a corresponding multiple conductor electrical cable 36 is connected to the rotatable assembly 16. As will be described hereinafter, the electrical connections between the electrical conductors of the cables 34 and 36 are maintained during the rotation of the rotatable assembly 16 about axis 32.

The exchange of electrical signals between the vehicle and the harvesting head 18 enables the control of a plurality of hydraulically powered devices of the harvesting head 18 without requiring a great number of fluid conduits. Indeed, the electrical signals supplied to the harvesting head 18 may be used to control electrically actuated valves (not shown) used to supply hydraulic fluid to the hydraulically powered devices of the harvesting head upon request by the user.

Advantageously, the vehicle includes a first controller (not shown) to which the electrical cable 34 is connected and the harvesting head 18 includes a second controller (not shown) to which the electrical cable 36 is connected. The first and second controllers may thus exchange power and control electrical signals enabling the second controller to control the valves (not shown) supplying fluid to the devices of the head 18. It is to be noted that sensors, for example position

sensors, may be provided on the head 18 to supply data to the first and second controllers.

The harvesting head 18 illustrated in Figure 1 includes a plurality of hydraulically powered devices to be controlled by the second controller. For example, the harvesting head 18 includes grapples 38, 40, a saw 42, feeder rollers 44, 46, a hydraulic cylinder 48 used to pivot the pivotable portion 50 of the head 18 about pivot pin 52.

Figure 2 of the appended drawings illustrates the continuous rotary link 10 in an enlarged perspective view. Since the operation of conventional continuous rotary links transmitting fluids from a fixed assembly to a rotatable assembly is believed well known to those skilled in the art, the fluid transmission system of the continuous rotary link 10 will only be described briefly hereinafter.

The fixed assembly 12 includes three fluid conduit connectors 54, 56 and 58 to which the fluid conduits 20, 22 and 24 may respectively be connected. As can be better seen from the exploded view of Figure 3, the fixed assembly 12 is provided with a cylindrical portion 62 including three circumferential channels 64, 66 and 68 each provided with an aperture connecting the channel to one of the fluid conduit connectors. On the other hand, the rotatable assembly 16 includes a cylindrical sleeve 70 having an internal diameter slightly larger than the outer diameter of the cylindrical portion 62. The sleeve 70 is provided with three fluid conduit connectors 72, 74 and 76 positioned to be registered with a respective circumferential channel 64, 66 or 68 when the sleeve 70 is mounted to the cylindrical portion 62. Each fluid connector 72, 74 and 76 is configured to receive one of the fluid conduits 26, 28 and 30.

Fluid exchange between the fixed assembly 12 and the rotatable assembly 16 is therefore possible even during the rotation of the rotatable assembly 16 about the cylindrical portion 62.

As will be easily understood by one skilled in the art, circumferential channels (not shown) could be provided in the internal surface of the sleeve 70 to replace the circumferential channels 64, 66 and 68 without modifying significantly the operation of the continuous rotary link 10.

It is to be noted that various elements illustrated in Figure 3 are advantageously used to provide an adequate continuous rotary link. For example, a hydraulically powered motor 78 of the rotatable assembly 16 has a pinion 80 engaged to a gear 82 fixedly mounted to the cylindrical portion 62 to cause the rotation of the rotatable assembly 16 about the rotation axis 32 upon activation of the motor 78.

It is also to be noted that in an alternate embodiment (not shown), the fixed assembly 12 and the rotatable assembly 16 could be swapped, i.e. the rotatable assembly 16 would be fixedly mounted to the boom 14, becoming a fixed assembly, while the fixed assembly 12 would be rotatably inserted in the rotatable assembly 16, becoming a rotatable assembly.

The continuous rotary link 10 of the present invention also includes an electrical signal transmission system for transmitting electrical signals from the fixed assembly 12 to the rotatable assembly 16.

The electrical signal transmission system includes a first electrical conductor port 84 provided in the fixed assembly 12, an electrical conductor conduit having a transversal portion 86 and a longitudinal portion (not shown) provided in the cylindrical portion 62, a first electrical connector assembly 88 (Figure 3) mounted to the end of the cylindrical portion 62, a second electrical connector assembly 90 (Figure 3) mounted to the cylindrical sleeve 70 and a second electrical conductor port 92.

Figures 4 and 5 of the appended drawings illustrate a part of the first and second electrical connector assemblies 88 and 90.

The first electrical connector assembly 88 includes four circular electrical connectors 94, 96, 98 and 100 mounted to a cylindrical projection 102 of the assembly 88 via five electrical insulators 104, 106, 108, 110 and 112 and via a mounting element 114.

The first multiple conductor electrical cable 34, including four electrical conductors 118, 120, 122 and 124, is inserted in the electrical conductor conduit of the fixed assembly 12. Each conductor 118-124 is electrically connected to a respective circular electrical connector 94-100.

The second electrical connector assembly 90 includes four electrical contact brushes 126, 128, 130 and 132 respectively mounted to the assembly 90 via a support 134 (schematically illustrated in dashed lines in Figure 4) to be in contact with one of the connector 94-100.

The second multiple conductor electrical cable 36 including four electrical conductors 136, 138, 140 and 142 is inserted in the electrical conductor port 92 of the rotatable assembly 16. Each conductor 136-142 is electrically connected to a respective electrical contact brush 126-132.

The respective electrical contact between the electrical connectors 94-100 and the electrical contact brushes 126-132 cause the respective continuous electrical connections between the electrical conductors 118-124 and the electrical conductors 136-142. The electrical contact between the first controller (not shown) of the vehicle and the second controller (not shown) of the harvesting head 18 may thus be continuous during the rotation of the harvesting head 18 with respect to the boom 14 of the vehicle.

It is to be noted that while the electrical signal transmission system has been shown herein as having four connections, this number is not an essential feature of the present invention but has been selected to illustrate a ground path, a power path and two coded control signal paths.

As will be easily understood by one skilled in the art, the electrical signal transmission system to allow the exchange of electrical signals between the fixed assembly 12 and the rotatable assembly 16 could be different from the electrical signal transmission system described hereinabove. For example, the brushes 116-122 could be replaced by ball bearing type brushes (not shown) or the brushes could be mounted to the fixed assembly 12 while the circular connectors would be mounted to the rotatable assembly 16. In other words, any adequate system

allowing an exchange of electrical signals between a fixed assembly and a rotatable assembly rotating about the fixed assembly could be used.

Although the present invention has been described hereinabove by way of preferred embodiments thereof, it can be modified, without departing from the spirit and nature of the subject invention as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A continuous rotary link for a multifunction head comprising:

a fixed assembly having a longitudinal axis;

a rotatable assembly mounted to said fixed assembly; said rotatable assembly being rotatable about said longitudinal axis;

means for transmitting fluid from said fixed assembly to said rotatable assembly; said fluid transmitting means having a first portion mounted to said fixed assembly and a second portion mounted to said rotatable assembly;

at least one electrical signal transmission assembly including a first electrical connector mounted to said fixed assembly and a second electrical connector mounted to said rotatable assembly; one of said first and second electrical connectors being circular and coaxial with said longitudinal axis; the other of said first and second electrical connector contacting said one electrical connectors and running on said one electrical connector upon rotation of said rotatable assembly about said axis;

whereby an exchange of electrical signals between said fixed assembly and said rotatable assembly is enabled by the continuous electrical contact between said first and second electrical connectors.

2. A continuous rotary link as recited in claim 1, wherein said first electrical connector is circular and coaxial with said longitudinal axis.

3. A continuous rotary link as recited in claim 2, wherein said second electrical connector includes an electrical contact brush contacting said first electrical connector.

4. A continuous rotary link as recited in claim 1, wherein said at least one electrical signal transmission assembly includes four electrical signal transmission assemblies.

5. A continuous rotary link as recited in claim 1, wherein said fixed assembly includes a cylindrical element and wherein said rotatable assembly includes a sleeve element configured to be rotatably mounted to said cylindrical element; said first portion of said fluid transmission means includes three fluid conduits respectively connected to three circumferential channels provided on an external surface of said cylindrical element; said second portion of said fluid transmission means including three fluid conduits so provided in said sleeve element as to be respectively adjacent to one of said circumferential channel when said sleeve is mounted to said cylindrical element.

6. A continuous rotary link as recited in claim 1, further comprising means to rotate said rotatable assembly about said longitudinal axis with respect to said fixed pivot assembly.

7. A continuous rotary link as recited in claim 6, wherein said rotating means include a hydraulically powered motor.

8. A continuous rotary link as recited in claim 1, wherein said fixed assembly also includes an electrical conductor conduit allowing electrical conductors to be inserted therein to be electrically connected to

said first electrical connector of said at least one electrical signal transmission assembly.

9. A continuous rotary link as recited in claim 1, wherein said fixed assembly in configured and sized to be mounted to an articulated boom of a vehicle.

10. A continuous rotary link for a multifunction head comprising:

a fixed assembly having a longitudinal axis;

a rotatable assembly rotatably mounted to said fixed assembly and configured to receive the multifunction head;

means for transmitting fluid between said fixed assembly and said rotatable assembly; said fluid transmitting means having a first portion mounted to said fixed assembly and a second portion mounted to said rotatable assembly;

means for transmitting electrical signals between said fixed assembly and said rotatable assembly; said electrical signal transmitting means having a first portion mounted to said fixed assembly and a second portion mounted to said rotatable assembly.

11. a continuous rotary link as recited in claim 10, wherein said electrical signal transmitting means include at least one electrical signal transmission assembly provided with a first electrical connector mounted to said fixed assembly and a second electrical connector mounted to said rotatable assembly; one of said first and second electrical connectors being circular and coaxial with said longitudinal axis; the other of said first and second electrical connector contacting said one electrical connectors and running on said one

electrical connector upon rotation of said rotatable assembly about said axis;

whereby an exchange of electrical signals between said fixed assembly and said rotatable assembly is enabled by the continuous electrical contact between said first and second electrical connectors.

12. A continuous rotary link as recited in claim 11, wherein said first electrical connector is circular and coaxial with said longitudinal axis.

13. A continuous rotary link as recited in claim 12, wherein said second electrical connector includes an electrical contact brush contacting said first electrical connector.

14. A continuous rotary link as recited in claim 11, wherein said at least one electrical signal transmission assembly includes four electrical signal transmission assemblies.

15. A continuous rotary link as recited in claim 10, wherein said fixed assembly includes a cylindrical element and wherein said rotatable assembly includes a sleeve element configured to be rotatably mounted to said cylindrical element; said first portion of said fluid transmission means includes three fluid conduits respectively connected to three circumferential channels provided on an external surface of said cylindrical element; said second portion of said fluid transmission means including three fluid conduits so provided in said sleeve element as to be respectively adjacent to one of said circumferential channel when said sleeve is mounted to said cylindrical element.

16. A continuous rotary link as recited in claim 10, further comprising means to rotate said rotatable assembly about said longitudinal axis with respect to said fixed pivot assembly.

17. A continuous rotary link as recited in claim 16, wherein said rotating means include a hydraulically powered motor.

18. A continuous rotary link as recited in claim 11, wherein said fixed assembly also includes an electrical conductor conduit allowing electrical conductors to be inserted therein to be electrically connected to said first electrical connector of said at least one electrical signal transmission assembly.

19. A continuous rotary link as recited in claim 10, wherein said fixed assembly in configured and sized to be mounted to an articulated boom of a vehicle.

20. A continuous rotary link as recited in claim 10, wherein said fixed assembly in configured and sized to be mounted to a telescopic boom of a vehicle.

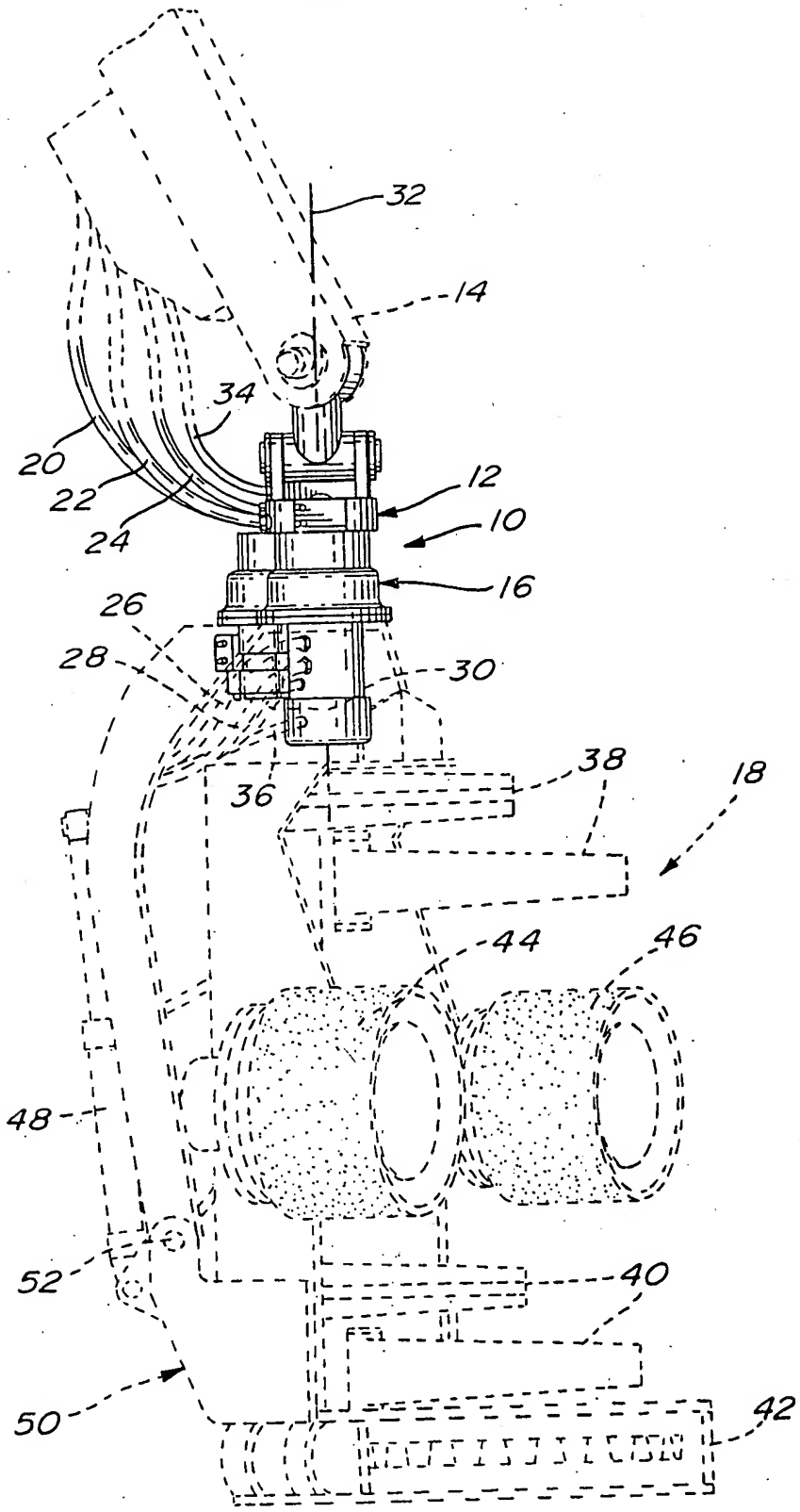



FIG. 1

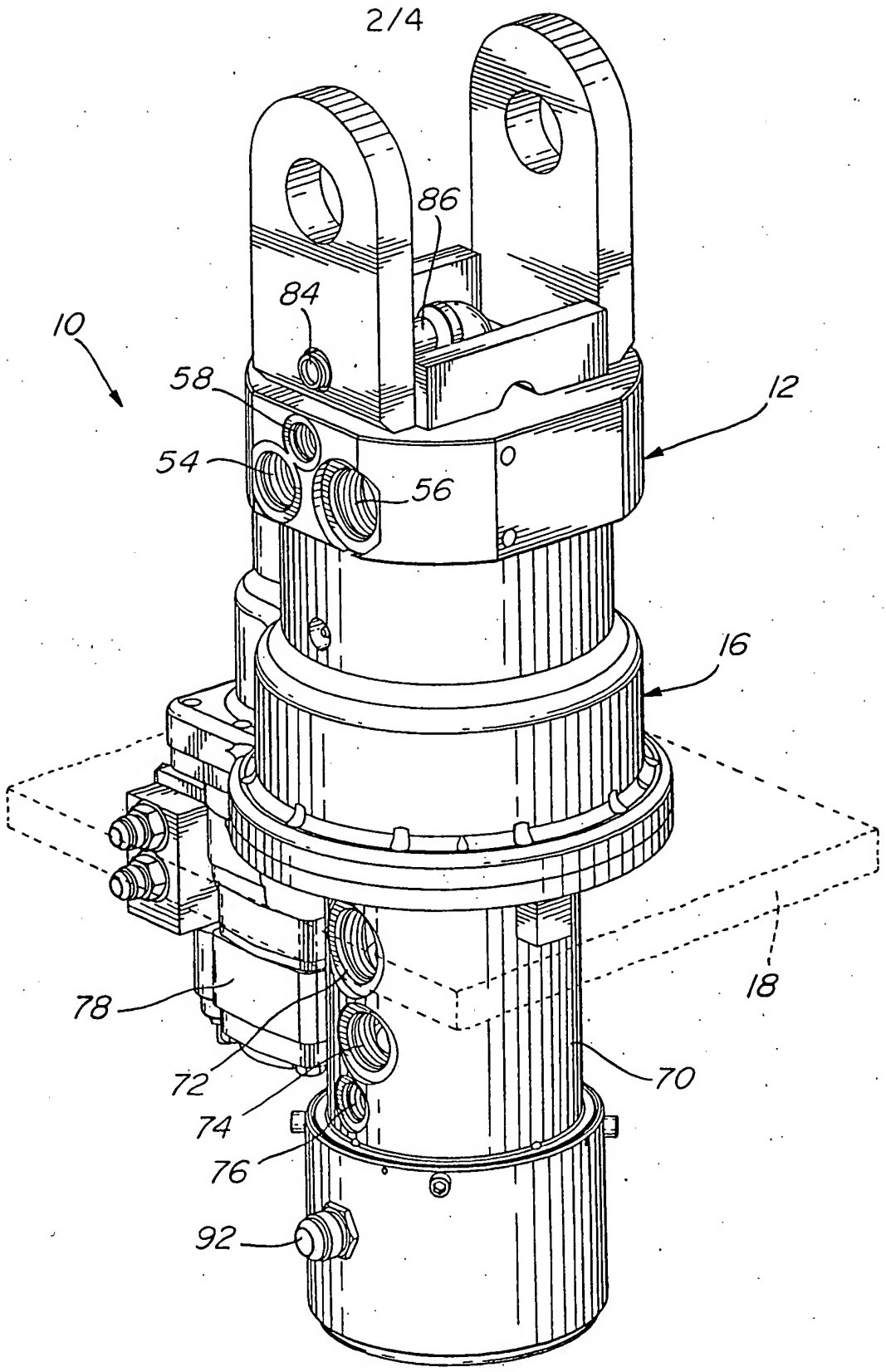



FIG. 2

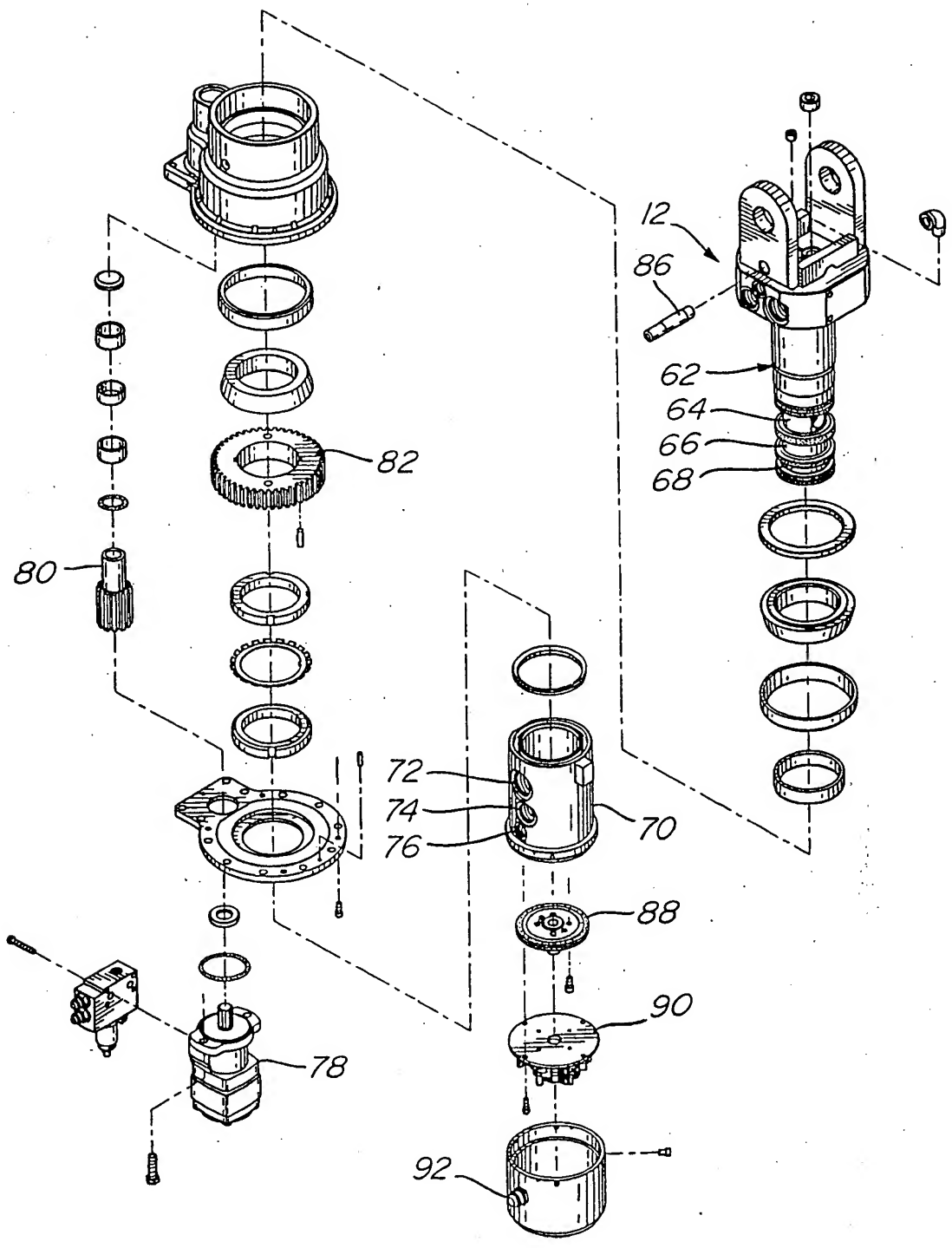



FIG. 3

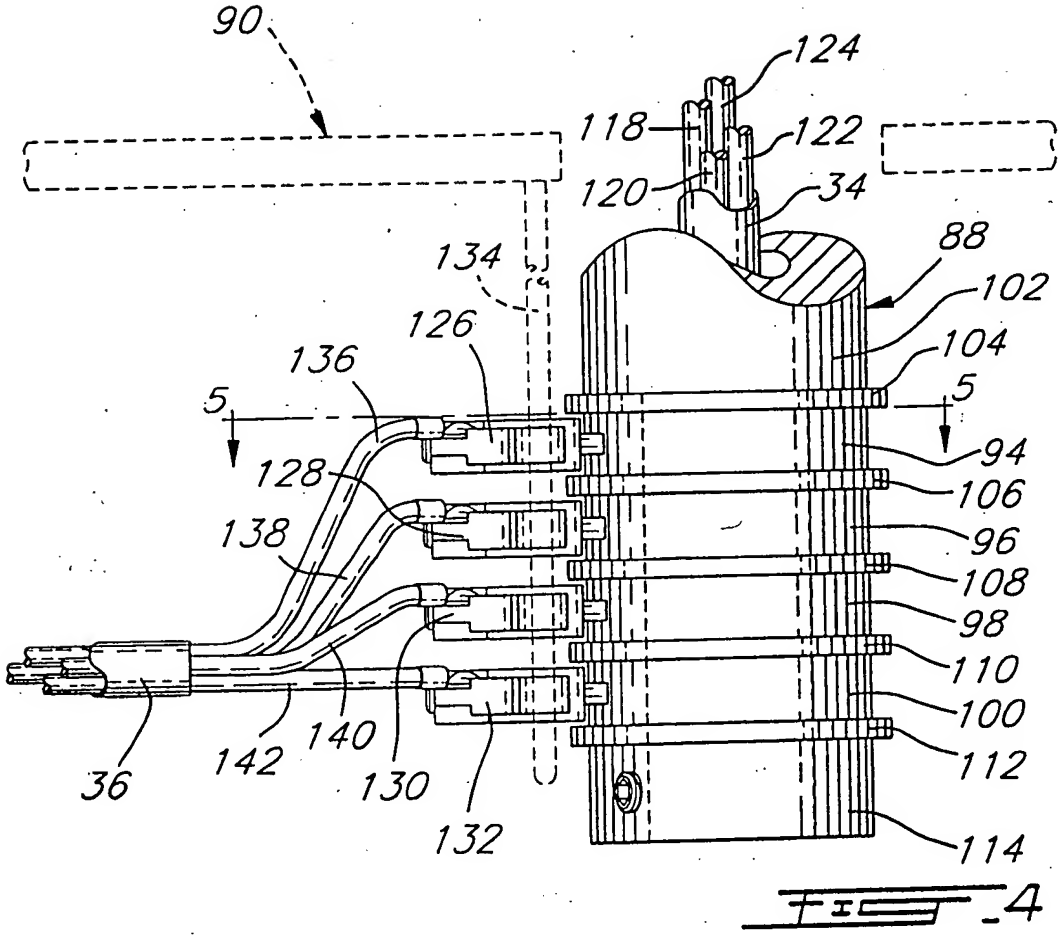

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Fig. 4

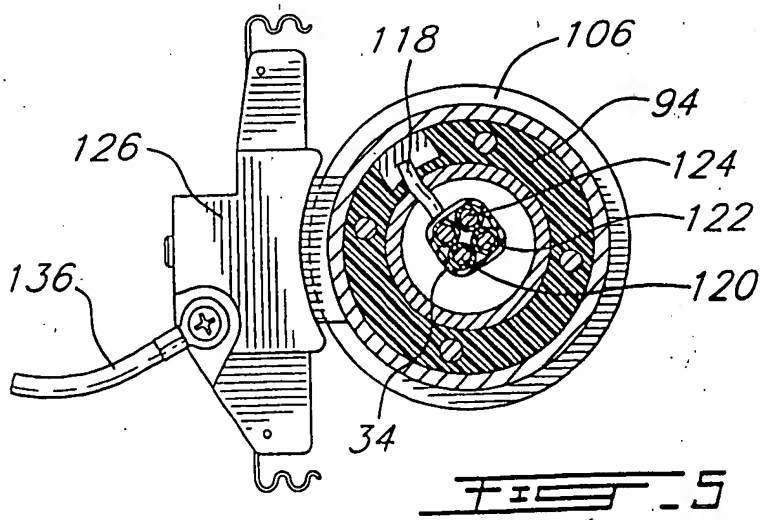
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Fig. 5

# INTERNATIONAL SEARCH REPORT

Inte. onal Application No
PCT/CA 99/00026

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 3 901 270 A (SMITH ROGER M)<br>26 August 1975<br>see column 2, line 22 - line 59; figure 1 | 1,5,10,<br>15 |
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# INTERNATIONAL SEARCH REPORT

Inte. ɔnal Application No
PCT/CA 99/00026

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A01G23/00 H01R13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A01G B66C E02F B66F H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 5 632 625 A (FAUST HEIN-PETER)<br>27 May 1997<br><br>see abstract<br>see column 1, line 9 - line 20<br>--- | 1-4,6,<br>8-14,<br>16-20 |
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 19 April 1999 | 27/04/1999 |

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Information on patent family members

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E02F 3/43

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340 30 VISLANDA SE
(72) UPPFINNARE CHRISTER LENNARTSSON VISLANDA SE

(30) PRIORITETSUPPGIFTER

(54) BENÄMNING ROTATOR

(57) SAMMANDRAG

Anordning för tiltning av arbetsverktyg och direkt dämpning av uppkommen svängningsrörelse inbyggd i den roterande delen av rotatorn samt genom rotatorns uppbyggnad erhållen öppning i dess mitt, som möjliggör central dragning av kablar och slangar.